

September 6, 2007

James M. Shuler  
Manager, Packaging Certification Program  
Safety Management and Operations  
Office of Environmental Management  
Department of Energy  
Washington, DC 20585

SUBJECT: REVISION 6 OF CERTIFICATE OF COMPLIANCE NO. 9315 FOR THE MODEL  
NO. ES-3100

Dear Dr. Shuler:

As requested by your letter dated August 28, 2007, as supplemented August 30, 2007, enclosed is Certificate of Compliance No. 9315, Revision No. 6, for the Model No. ES-3100 package. You requested the revision to the definition of allowable unirradiated TRIGA fuel for this package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users may request, by letter, to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me or Kim Hardin of my staff at (301) 492-3294.

Sincerely,

**/RA/**

Robert A. Nelson, Chief  
Licensing Branch  
Division of Spent Fuel Storage and Transportation  
Office of Nuclear Material Safety  
and Safeguards

Docket No. 71-9315

TAC No. L24120

Enclosures: 1. Certificate of Compliance  
No. 9315, Rev. No. 6  
2. Safety Evaluation Report  
3. Registered Users

cc w/encls 1 and 2: R. Boyle, Department of Transportation  
Registered Users  
J. Arbital, BWXT Y-12

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**SAFETY EVALUATION REPORT**  
**Docket No. 71-9315**  
**Model No. ES-3100 Package**  
**Certificate of Compliance No. 9315**  
**Revision No. 6**

**SUMMARY**

By application dated August 28, 2007, as supplemented August 30, 2007, the Department of Energy (DOE or the applicant) requested Revision No. 6 to Certificate of Compliance (CoC) No. 9315, for the Model No. ES-3100 package. This revision modifies the approved contents to include unsectioned fuel elements with stainless steel clad to the currently approved contents for unirradiated Training, Research, Isotopes, and General Atomics (TRIGA) reactor fuel, including air transport, and will support safe shipments to support the DOE NNSA Foreign Research Reactor (FRR) Program.

The submittal was evaluated against the regulatory standards in 10 CFR Part 71, including the general standards for all packages, standards for fissile material packages, and performance standards under normal conditions of transport (NCT) and hypothetical accident conditions (HAC). Staff reviewed the application using the guidance in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material."

Based on the statements and representations in the application, as supplemented, and the conditions listed in the CoC, the staff concludes that the design has been adequately described and evaluated and meets the requirements of 10 CFR Part 71.

**GENERAL INFORMATION**

By application dated August 28, 2007, as supplemented August 30, 2007, DOE requested the revision of the definition of allowable unirradiated TRIGA fuel in the ES-3100 shipping package.

The CoC currently authorizes, in paragraph 5.(b)(4), unirradiated TRIGA fuel pellets (sections), which are removed from the cladding, for transport. DOE requests the authorization to include unsectioned elements whose stainless steel cladding is intact and crimped on either end. The maximum amount of fissile material is not changed.

**CRITICALITY EVALUATION**

The applicant revised the criticality safety analysis for the Model No. ES-3100 package to consider TRIGA fuel elements with cladding as allowable contents for air transport. A previously approved amendment included criticality analyses demonstrating that disassembled TRIGA fuel elements, consisting of  $\text{UZrH}_x$  fuel material in five inch segments, are adequately subcritical under the accident conditions of 10 CFR 71.55(f). This revision would allow for the shipment of TRIGA fuel elements that have had the non-active fuel regions of the cladding removed, and the protruding clad at each end crimped closed. The allowable mass of fissile material is the same as for disassembled TRIGA elements.

The cladding for the TRIGA fuel elements may be either aluminum or stainless steel. The cladding thickness is nominally 0.02 inches and 0.03 inches for stainless steel and aluminum, respectively. The applicant revised the criticality analysis for normal conditions of transport under §71.71, hypothetical accident conditions under §71.73, and air transport accident conditions under §71.55(f), to consider the reactivity effect of adding fuel cladding to the previously approved contents.

Stainless steel acts as a neutron absorber and displaces a small amount of moderator in the criticality models, resulting in a reduction in reactivity. Aluminum does not absorb neutrons as effectively as stainless steel, but still displaces moderator, which will tend to reduce reactivity in the criticality models. In both cases, the previous criticality model for disassembled TRIGA fuel elements is bounding under all conditions.

The applicant has shown and the staff agrees that the Model No. ES-3100 package continues to meet the criticality safety requirements for fissile material single packages under §71.55, for air transport of fissile material packages under §71.55(f), and for arrays of packages under §71.59, for TRIGA fuel elements with stainless steel or aluminum cladding.

Based on the statements and representations in the application, as supplemented, and the conditions listed in the CoC, the staff concludes that the design has been adequately described and evaluated and meets the requirements of 10 CFR Part 71.

## **CONDITIONS**

The CoC has been revised as follows:

Condition No. 5.(b)(4):

The revision modifies the approved contents to include unsectioned fuel elements with stainless steel clad to the currently approved contents for unirradiated TRIGA reactor fuel for the ES-3100 transportation package.

Condition No. 14:

Allows the use of Revision 5 of this certificate for one year.

## **CONCLUSION**

The Certificate of Compliance is revised to modify the approved contents for unirradiated TRIGA reactor fuel to be shipped in the ES-3100 transportation package.

This change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9315, Revision No. 6 on  
September 6, 2007.